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H2H

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(54) Lighting system

(57) The series circuit of a high pressure gas discharge lamp 1 and an inductive filter 2 is connected to the output of a rectifier unit 3 having its input connected to an A.C. supply, and a ballast element is also connected to the rectifier 3. The ballast element may be a capacitor (6), (Fig. 3), in series with the input of rectifier, or a resistor 4 in series with the input or the output (Fig. 2) of the rectifier. The resistor 4 may be an incandescent filament arranged in a common envelope with the lamp 1.

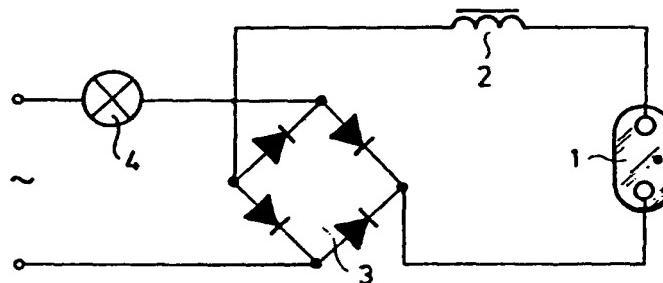


Fig.1

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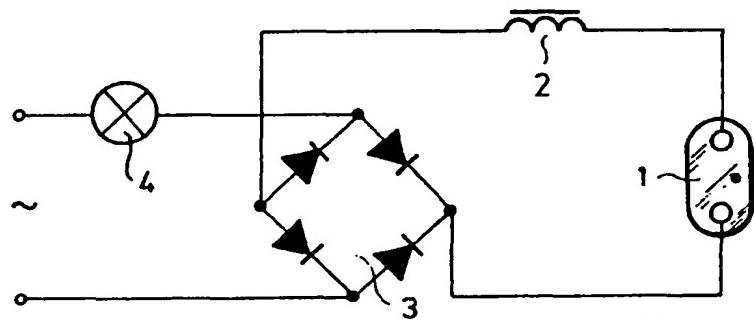


Fig.1

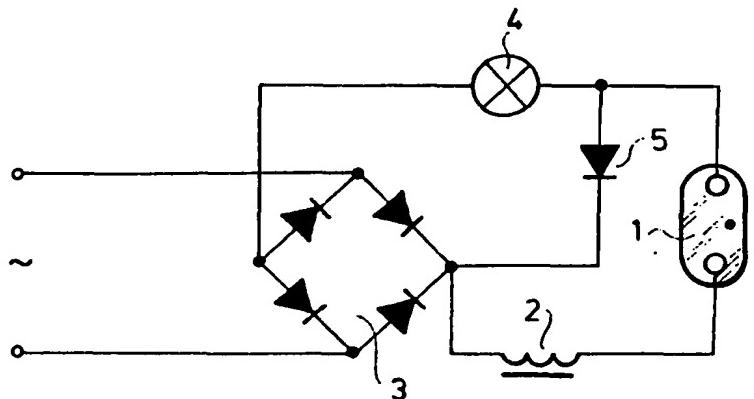


Fig.2

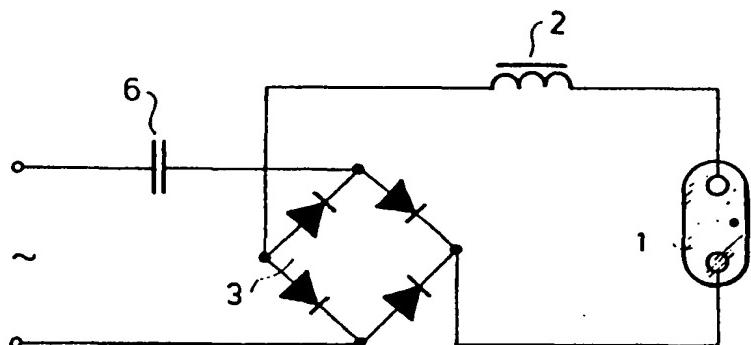


Fig.3

SPECIFICATION

Lighting system

- 5 **BACKGROUND OF THE INVENTION**
The invention relates to a lighting system, comprising according to the art a rectifier unit for transforming A.C. voltage into D.C. voltage, a high-pressure lamp, e.g. a high-pressure sodium vapour lamp or a high-pressure metal halogenide lamp of low power, a ballast element and if desired an ignition unit. The lighting system according to the invention is capable of diminishing the inclination of the mentioned lamps to being extinguished and thereby ensures the possibility of wide use of the high-pressure sodium vapour lamps or high-pressure metal halide lamp especially of low power.
- 10 As known, the start of the high-pressure sodium-vapour lamps and the high-pressure metal halide lamps of current consumption at most as high as 1 A is difficult: it is necessary to ensure a high voltage peak for restarting the lamp after extinction. It is known also that these lamps have an inclination to extinguishing the gas discharge process if using supply voltage of 50 Hz or 60 Hz frequency. Therefore efforts have been made for ensuring supply of these lamps and especially their miniaturised versions by high-frequency alternating current or by rectified high-frequency current pulses, as it has been described in the US-PS 4 170 746 or SU-PS 496 700. When applying a high-frequency current or rectified pulses to the high-pressure lamp the frequency should be selected taking into account some phenomena. The disadvantageous frequency value can result in acoustic noises
- 15 polluting the environment or in harmful resonance causing damages in the entire lighting system. For these lamp systems it is characteristic that the ballast means arranged on the input of the light source are of sophisticated construction and this can undesirably influence the reliability of operating and the costs of the lighting system.

- SUMMARY OF THE INVENTION**
- 20 The object of the invention is to create a lighting system, wherein the inclination of the high-pressure lamp to being extinguished can considerably be diminished, whereby the dimensions and the power consumption of the lighting unit can be decreased in comparison to the known units.

The invention is based on the recognition that for supplying the known high-pressure sodium vapour of high-pressure metal halide lamps and some other types of low power high-pressure light sources instead of the known high-frequency circuit arrangements it is advantageous to select a rectifier unit and an inductive filter on the output thereof,

25 wherein if desired a resistive ballast element

can be inserted for limiting current. Because the rectifier unit is connected to an alternating current source the high-pressure light source is supplied by a filtered direct current. The

- 30 applied filter unit limits the ripple of the voltage to a minimal value and this causes a diminished inclination of the lamp to being extinguished.
In order to reach the object set a lighting unit has been created, comprising A.C. input terminals, a rectifier unit for transforming A.C. voltage into D.C. voltage, a high-pressure light source with an anode and a cathode, a ballast element and an inductive filter, wherein according to the invention the high-pressure light source and the inductive filter form a series member connected directly or across the ballast element being resistive to the D.C. output of the rectifier unit.
- 35 For limiting the current of the lighting unit it is very advantageous to use a real resistive element as ballast element, e.g. a filament. This solution is especially desired when a mixed light source should be realised which
- 40 comprises as it is known, a filament and a gas-discharge light source arranged in a common bulb. Such a light source cannot be realised on the basis of the known high-pressure sodium vapour lamps applying the known circuits of A.C. supply because of the strong tendency of the lamps to being extinguished. It means that according to the invention it is proposed to realise a lighting system comprising a filament as a resistive ballast
- 45 element arranged in a common bulb with the high-pressure light source. The resistive ballast element can be arranged on the A.C. input of the rectifier unit and on the D.C. output thereof, as well.
- 50 The series member can be connected to the output of the rectifier unit, as mentioned, across a resistive ballast element. For increasing the filtering effect a diode can be arranged parallel to the series member, wherein the
- 55 diode is polarised in inverse direction to the output polarity of the rectifier unit.
When selecting the position of the resistive ballast element either on the input, or on the output of the rectifier unit it should be taken
- 60 into account that in the first case a lighting unit comprises four input terminals, and in the second, when a mixed light source is realised it is sufficient to apply three input terminals.
The resistive ballast element in form of a
- 65 filament has the further advantage that the lighting system with a filament has a low tendency to being extinguished, because it is known that the filament contributes to the stabilisation of current, whereby the lighting system has low sensitivity against the fluctuation of the mains voltage.
It is also advantageous to use a capacitive ballast element arranged on the input of the rectifier unit, whereby the effectiveness of the
- 70 lamp can be improved.

Direct current supply, however, can cause some changes in the electrodes of the high-pressure sodium vapour lamps or the high-pressure metal halogenide lamps. In order to 5 compensate these changes it is proposed to construct the electrodes asymmetrically. The asymmetry means that the cathode comprise more emissive material than the anode, wherein it is also possible to select anode 10 without any emissive material or an anode greater than the cathode.

The advantages of the lighting system according to the invention are: the ripple of the supply current can be diminished and thereby 15 it is possible to lower the tendency of the lighting system to being extinguished and the power consumption thereof in comparison to the known solutions, to elaborate an effective mixed light source on the basis of a high-pressure sodium vapour or metal halogenide lamp or other such kind light sources. It is possible to use a filament as a resistive ballast element. The light output of the proposed 20 lighting system is free of intensive ripple and high-frequency strays. A further advantage lies in the simplicity of the construction and thereby of the production, in the lowered costs of the proposed structure in comparison 25 to the known ones.

30 BRIEF DESCRIPTION OF DRAWINGS

The invention will be described in more detail by way of example and with reference to preferred embodiments illustrated in the 35 drawing, wherein

Figure 1 is a circuit diagram of an advantageous embodiment of the proposed lighting system, wherein a resistive ballast element is connected to the input of the rectifier unit,

Figure 2 is a circuit diagram of another advantageous embodiment of the proposed lighting system, wherein a resistive ballast element is connected to the output of the rectifier unit, and

Figure 3 is a circuit diagram of a further advantageous embodiment of the proposed lighting system, comprising a capacitive ballast element.

50 DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown on the drawing, the lighting system according to the invention comprises a high-pressure light source 1, e.g. a high-pressure sodium vapour or metal halogenide lamp with an inductive filter 2 on its input or output forming together with the high-pressure light source 1 a series member connected to a D.C. output of a rectifier unit 3. 55 This means the high-pressure light source 1 is connected to a rectifier unit which is realised e.g. in form of a full wave rectifier built-up as a Graetz-rectifier.

According to Fig. 1 a resistive ballast element 4 is connected to the A.C. input of the

rectifier unit 3 supplied from an A.C. network of voltage e.g. 220 V and frequency 50 Hz. The resistive ballast element 4 can be e.g. a lamp filament arranged in a bulb and supplied 70 with voltage 220 to 230 V at power consumption in range 100 W. In this case the high-pressure light source 1 is connected to the D.C. output of the rectifier unit 3. As an example of the inductive filter 2 a coil with 75 inductivity 1.2 H can be mentioned. The full power consumption of the entire lighting system shown in this Figure is in the range of 60 W.

In the circuit diagram of Fig. 2 the rectifier unit 3 is connected directly to the A.C. terminals supplied by a voltage 220 V of 50 Hz frequency and the resistive ballast element 4 is on the direct current output of the rectifier unit 3. In this case it is advantageous to 80 select a resistive ballast element 4 as that of Fig. 1, in form of a filament. In the series member the inductive filter 2 is connected to the direct current output of the rectifier unit 3. For improving the filtering effect a diode 5 is 85 inserted parallel to the series member. The high-pressure light source and the filament are advantageously arranged in a common bulb.

As it is shown in Fig. 3 it can be advantageous to use a capacitive ballast element 6 90 connected to the A.C. input of the rectifier unit 3. The element ensures also a limitation of the current. It has been proved to be advantageous to select the value 5, 6 μ F for a condenser as the capacitive ballast element 6, 95 which operates together with the inductive filter 2 of 1,2 H and ensures the power consumption of the lighting system supplied with voltage 220 V of network frequency 50 Hz in the range from 20 to 30 W, depending 100 on the parameters of the high-pressure light source.

In the circuit diagrams shown above it can be advantageous to use an appropriate ignition unit or ignition means /for example a 110 Penning-mixture/.

The starting conditions of the high-pressure light unit 1 can be improved by suitable selecting the parameters of the cathode and anode /not shown/ of the source. If the 115 electrodes are arranged in an asymmetrical manner, e.g. the anode is greater than the cathode or the emissive material is present in the cathode in a higher amount than in the anode it will be possible to compensate the 120 changes involved by the D.C. supply of the electrodes.

It can be seen that a lighting system of simple construction has been proposed which is characterized by low power consumption, 125 high reliability of operating even in case of applying low power high-pressure sodium vapour, metal halogenide and other lamps.

From the above description, it should be understood that circuits equivalent to those given above will be within the scope of

claimed invention and such circuits will depend on the kind of the high-pressure light sources used therein and the given circumstances.

5 CLAIMS

1. Lighting system, comprising A.C. input terminals, a rectifier unit for transforming A.C. voltage into D.C. voltage connected to respective input terminals, a high-pressure light source with a cathode and an anode, a ballast element and an inductive filter, wherein the ballast element is connected to the rectifier unit, and the high-pressure source and the inductive filter form a series member connected directly to the D.C. output of the rectifier unit.
2. A lighting system according to claim 1, wherein the ballast element is a resistive element connected between one of the input terminals and the respective input of the rectifier unit.
3. A lighting system according to claim 1, wherein the ballast element is a resistive element connected between one of the input terminals and the respective output of the rectifier unit.
4. A lighting system according to any preceding claim, comprising a lamp filament as the resistive ballast element.
5. Lighting system, comprising A.C. input terminals, a rectifier unit for transforming A.C. voltage into D.C. voltage connected to respective input terminals, a high-pressure light source with a cathode and an anode, a resistive ballast element and an inductive filter, wherein the resistive ballast element connected to the D.C. output of the rectifier unit, the high-pressure light source and the inductive filter form a series member.
6. A lighting system according to claim 5, comprising a diode connected parallel to the high-pressure light source and the inductive filter, wherein the diode is polarised in inverse direction to the output polarity of the rectifier unit.
7. A lighting system according to claim 5 or 6, wherein the resistive ballast element is a filament arranged together with the high-pressure light source in a common bulb.
8. A lighting system according to any preceding claim, wherein the cathode comprises more emissive material than the anode.
9. A lighting system according to any preceding claim, wherein the anode is of greater dimension than the cathode.
10. A lighting system according to any preceding claim, comprising ignition means facilitating starting the high-pressure light source.
11. A mixed light lamp including a lighting system according to any preceding claim.
12. A lighting system substantially as herein described with reference to and as shown in Fig. 1 or 2 or 3 of the accompany-

ing drawing.

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